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What is greenhouse effect? What is the mechanism of greenhouse effect? Which major air pollutants are responsible for causing global warming? Why is Pakistan considered more vulnerable to the effects of climate change when its contribution is less than 1% in total GHG emissions?

INTRODUCTION

The industrial revolution started in the late 18th century and is going on till this day. Since that time, man's activities are contributing to the growth of their cities, betterment of their lifestyles and raised his overall standard of living.

However, this has come at a grave cost. While industrializing his cities the environment was being damaged. The anthropogenic activities of man released various chemicals in the atmosphere that acted as a blanket and trapped heat. Eventually, this effect was called as the 'Greenhouse Effect'.

GREENHOUSE EFFECT - AN

INTRODUCTION

The greenhouse effect is a natural process that occurs on the Earth and other planets. The effect is a thermal process, in which

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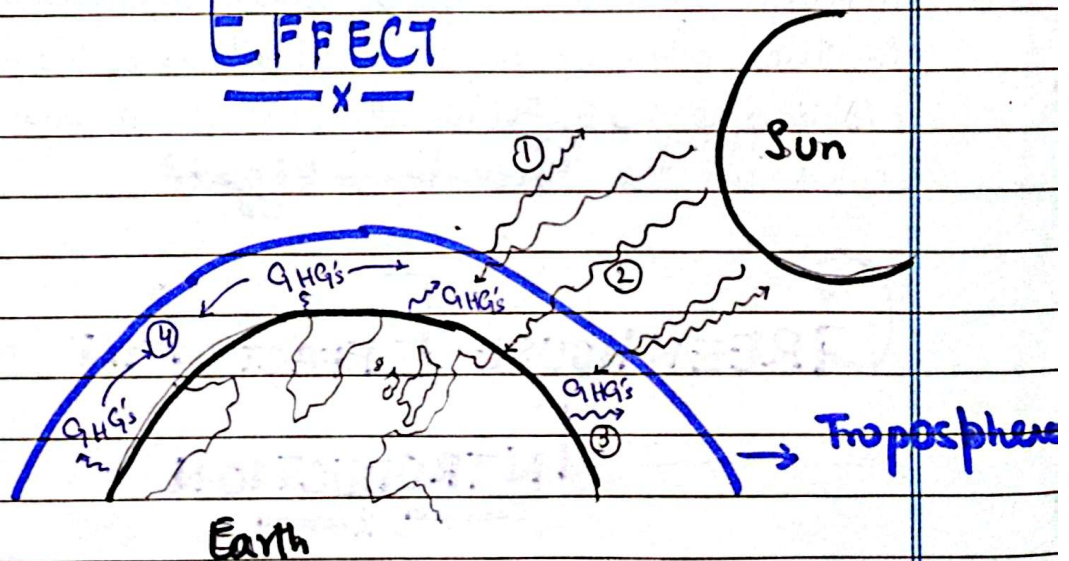
certain gases released by the warmed surface of the Earth absorb ^{thermal} radiation emitted by the Sun.

After coming in contact with this radiation, they re-emit the heat back to the Earth. Most natural greenhouse effect is due to the water present in the atmosphere.

'Water vapour and small particles of water account for 85% and 12% respectively of the total natural greenhouse effect'

Some other contributors are CH_4 , NO_x and CFCs

MECHANISM OF GREENHOUSE EFFECT



Greenhouse gases ^{at ②} are released by human/natural processes. These gases are then found in the

Troposphere. The troposphere, having the presence of winds, spreads the greenhouse gases across it. Upon the contact of solar radiation at (2) the gases absorb the radiation and some descends to the surface of the Earth. At (1), some of the solar radiation is reflected back at/towards the Sun.

Excessive heat from the surface of the Earth is radiated towards the Sun, at point (3), that heat eventually gets trapped by the GHGs. These gases after getting warmed by the heat re-emit the heat towards the surface of the Earth.

This creates a greenhouse effect. The trapped heat results in warming up of the temperatures, and create a negative feedback loop for climate change.

Furthermore, heat is scattered due to the winds and ends up warming the whole planet.

'Greenhouse effects keep the Earth's lower atmosphere approximately 33°C warmer than it would be otherwise.

It helps to limit temperature swings and maintain relatively comfortable surface temperature.'

(Botkin & Keller)

The greenhouse effect is not a concern but the changes

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to the greenhouse effect are concerning.

MAJOR AIR POLLUTORS RESPONSIBLE FOR GLOBAL WARMING

<u>Gases &</u>	<u>Relative Contribution</u>	<u>Growth Rate</u>
CFC's	15-25%	5%
CH ₄	12-20%	0.4%
O ₃ (Troposphere)	8%	0.5%
N ₂ O	5%	0.2%
CO ₂	50-60%	0.3-0.5%

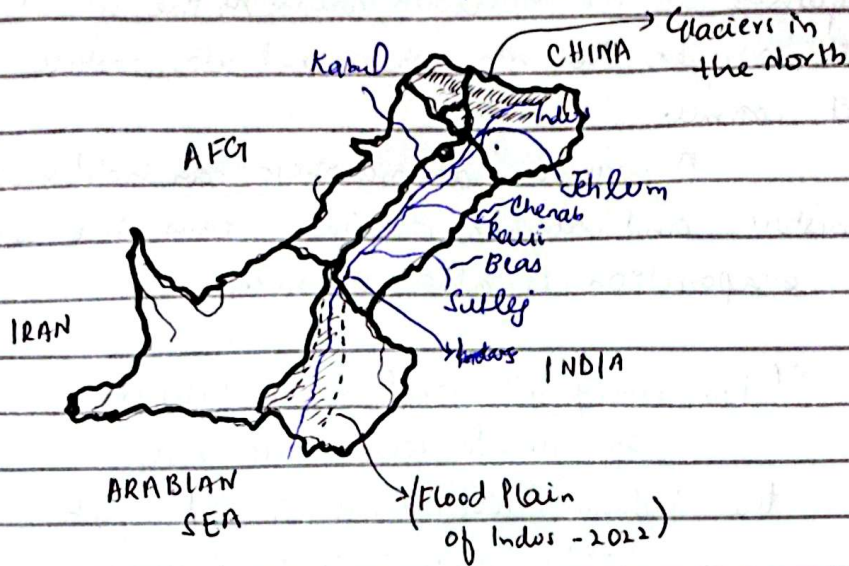
(IPCC Data)

The IPCC estimates 200 Billion metric tons of CO₂ enter and the atmosphere annually. Moreover, 50-60% of the anthropogenic greenhouse effect is caused by the CO₂.

The 2nd main contributor to the GHE is methane (CH₄). Methane is released by a variety of sources that range from usage of fossil fuels, agricultural practices and bacterial/microbial activities.

CFC's contribute to the GHE by a staggering 15-25% annually. They are relatively stable compounds in the lower atmosphere but break down in the stratosphere resulting in Ozone depletion.

PAKISTAN AND THE THREAT OF CLIMATE CHANGE



Pakistan contributes less than 1% to the global emissions. However as per UN-Habitat and Global Climate Risk Index

'Pakistan ranks as 5th most vulnerable country to Climate Change.'

In 2022, the country was ravaged by floods and the following statistics were revealed:

- 33 million had been affected; 8 million displaced from their homes. (UN-Habitat)
- The cost of damages ranged from PKR 3.2 - 3.3 Trillion. (GoP)
- Close to 1800 people were killed. (GoP)
- The country received 190% more rain than its 30 year average. (PMD)

a) The Indus Basin's Flooding Due to Monsoon Rain

Climate change has changed the intensity and frequency of the monsoon rains. As the world gets warmer, the atmosphere and atmosphere get warmer.

A warmer atmosphere can hold more moisture and warmer oceans means the level of evaporation is also higher.

'For every additional degree Celsius of global temperature rise, the Indian subcontinent should expect a 5-3% increase in precipitation during the monsoon.'

(Economist)

The floods of the 2022 are evidence of the above study. As mentioned above, meteorologists calculated that the country received 190% more rain than the average in June-August.

b) Climate Change and accelerated Global Melting

Climate change has increased glacial melting in Pakistan's north. Pakistan has 7253 glaciers. It is also referred to as the 'Earth's 3rd Pole.'

Due to the warming climate, the glacial melting has accelerated. Risk of GLOF or glacial lake outburst flood has also increased. Moreover,

down-stream flooding is also a risk to be considered.

In 2021, during the floods close to 33 glaciers and lakes were identified as at risk of bursting. Later on, some of these lakes did burst and resulted in flooding in isolated valleys across northern Pakistan.

'Over 1 million are at risk in KP and GB, and out of 26.7% and 22% live below the poverty line, due to GLOFs'
(MoCC)

c) Heatwaves and Droughts are more prevalent in the Center of the Country

Pakistan's center and south is facing acute droughts that are aggravated by heatwaves across the region.

The country recorded extreme temperatures crossing 50°C in the south of the country. During 2021, similar conditions and the then Climate Change minister had remarked

'Pakistan has been a springless year!'

Later that year, the country saw devastating floods. Heatwaves have become a norm and now are much common in the country. In this year alone close to 500 people had died in Karachi alone and scores admitted. As climate change transforms the global temperature patterns many in Pakistan

are facing the brunt of it.

CONCLUSION

← Pakistan and the whole world have been devastated by the phenomenon of climate change that has been aggravated by the Greenhouse effect. Greenhouse gases trap and re-emit the heat, warming the earth and contributing to melting of glaciers, prolonged heatwaves and much more. Pakistan is facing the brunt of this and the recent floods, droughts and heatwaves are evidence of this.